(54) Title: ELECTRONIC BATTERY TESTER WITH NETWORK COMMUNICATION
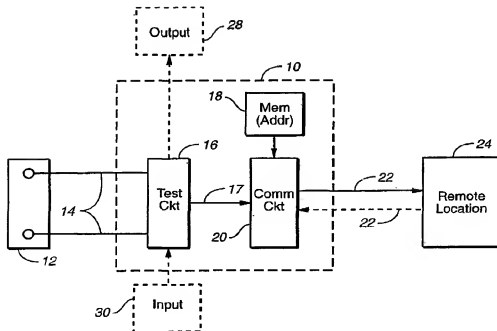
(57) Abstract: An electronic battery tester (10) for testing a storage battery (12) includes test circuitry (16) configured to provide a battery test output (17) related to a condition of the battery (12). A memory (18) stores a battery tester address of the battery tester (10), and communication circuitry transmits the battery test output formatted with the battery tester address on a communication link to a remote location.

WO 03/076960 A1

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ELECTRONIC BATTERY TESTER WITH NETWORK

COMMUNICATION

BACKGROUND OF THE INVENTION

The present invention relates to electronic
5   battery testers of the type used to perform tests on
storage batteries. As storage batteries have found
increasing use in various industries, the use of
electronic battery testers to test those batteries
has expanded. Example uses include batteries for
10   vehicles   (with   or   without   internal   combustion
engines) and batteries for back up power supplies
such   as   those   used   in   telecommunication
installations.

To   address   this   increased   use,   various
15   diagnostic and testing techniques and systems for use
with storage batteries have advanced in recent times.
However, a typical electronic battery tester simply
provides an output which is viewed by a user or
technician. The data is used to make a determination
20   regarding   the   condition   and   possible   need   for
replacement   of   a   storage   battery.   Once   that
determination is made, the output from the battery
tester is typically discarded when the battery tester
is disconnected.

25   The increasing use of electronic battery
testers has resulted in an increasing number of battery
tests which are performed and consequently resulted in
an   increased   amount   of   data   related   to   storage

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batteries. However, advantages from this increased
amount of data has been largely unrecognized.

SUMMARY OF THE INVENTION

    An electronic battery tester for testing a
storage battery includes test circuitry configured to
couple to the storage battery and provide a battery
test output related to a condition of the battery. A
memory is configured to store a battery tester
address of the battery tester. Communication
circuitry transmits the battery test output formatted
with the battery tester address on a communication
link to a remote location.

BRIEF DESCRIPTION OF THE DRAWINGS

    Figure 1 is a simplified block diagram of a
battery tester in accordance with one example
embodiment of the present invention.

    Figure 2 is a simplified flow chart showing
steps in accordance with one example embodiment of
the invention.

    Figure 3 is a simplified block diagram
showing steps associated with retrieving data in
accordance with one example embodiment of the
invention.

    Figure 4 is a simplified block diagram
showing steps in accordance with receiving battery
test data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

    The present invention includes the
recognition that the output from electronic battery

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testers   can   provide   useful   diagnostic   or   other
information for analysis to a remote location. In one
aspect, the present invention includes providing an
electronic   battery   tester   with   a   battery   tester
5   address   and   transmitting   the   result   of   a   battery
test, data recovered the test during or from the
battery, or related to the battery test, to a remote
location   in   a   manner   in   which   the   battery   tester
address is formatted (i.e., in some way combined or
10   associated with) with the battery test data. This
information is transmitted to a remote location for
subsequent   review   or   processing.   Similarly,   the
battery   tester   can   receive   information   when   the
information   is   associated   with   the   battery   tester
15   address.

            Figure   1   is   a   simplified   block   diagram
showing an electronic battery tester 10 in accordance
with one example embodiment of the present invention.
Electronic   battery   tester   10   couples   to   storage
20   battery 12 through electrical connections 14. In one
embodiment,   connections   14   are   Kelvin   connections.
However,   the   invention   is   not   limited   to   such   a
configuration.   The   connection   can   be   any   type   of
connection including non-physical connections and can
25   comprise   any   number   of   connections.   Electronic
battery tester 10 includes test circuitry 16 which is
configured to perform a test on battery 12 using any
type of known or yet to be discovered battery test
and provide a battery test result (or output) 17.

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A memory 18 contains a battery tester
address associated with the battery tester 10. In
some embodiments, the address is not unique.
Communication circuitry 20 couples to the test
5   circuitry 16 and the memory 18 and is configured to
format information related to the battery test
(battery test data) along with the battery tester
address on a communication link 22. Line 22 can, for
example, couple to a remote location 24. The
10 communication link 22 can operate bi-directionally or
in a single direction, carrying data between tester
10 and remote location 24. The link 22 can be a
network, such as a computer network. Example network
implementations include ethernet, token ring, PPP
15 (point to point protocol), SLIP, or other protocols
including proprietary protocols.

Figure 1 also illustrates an optional
output 28 which can be used to provide an output
related to the battery test. Similarly, an optional
20 input 30 can be used to input data. For example, the
data can relate to the type of battery 12 or be used
in the determination of a relative condition of
battery 12, for example by receiving a battery
rating. The output 28 and the input 30 can be for use
25 by an operator, such as a display and a manual input,
or it can be coupled to other equipment. The input 30
and output 28 can be over physical or non-physical
connections. The various components of battery tester
10 including output 28 and input 30, can be

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implemented using any number of components and Figure
1 is provided to illustrate a simplified block
diagram. With microprocessor based circuitry, the
various blocks illustrated in Figure 1 may be
5   implemented in shared components and their physical
implementation may not break down into the discrete
blocks illustrated in the Figure. The various
components can be implemented in hardware, software
or their combination.

10   Figure 2 is a simplified block diagram 50
showing example steps in accordance with the present
invention. The various steps shown in Figure 2 may be
implemented in any order, or wholly or partially in
parallel, and are not limited to the particular
15 implementation shown in the Figure. At block 52, the
process starts and control is passed to block 54
where the storage battery 12 is tested. At optional
block 56, battery test data is obtained. This can be
any data which is related to the battery test and may
20 or may not include the battery test result obtained
at block 54. At block 58, the address of the battery
tester 10 is obtained from memory 18. At block 60,
tester 10 formats the battery test data with the
battery tester address. The formatted data is
25 transmitted over communication link 22 at block 62.

            The battery test performed at block 54 by
test circuitry 16 can be any known or yet to be
discovered battery test. In one aspect, the battery
test is based upon a dynamic measurement, that is a

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measurement in which a time varying signal is used in
performing   the   battery   test.   In   another   example
aspect,   electrical   connections   14   comprise   Kelvin
connections.

5   The battery test output 17 can be any type
of output from a battery test including a qualitative
or a ·quantitative output. The optional battery test
related data can be any type of·data related to the
battery test including various measurements used in
10 obtaining the battery test output (such as voltages,
currents,   information   related   to   timing,   time
periods, signals and waveforms, etc.). or other types
of data including temperature (either ambient or some
other temperature such as the temperature of battery
15 12),   battery   serial   number,   model   number,   vehicle
identification   or   serial   number,   geographic   related
information, time and/or date information, data which
identifies the operator, the steps performed by the
operator or the battery test, the vehicle VIN number,
20 data obtained from the vehicle computer or computer
system, data related to the architecture of a backup
or   auxiliary   battery   site   including   the   equipment,
number of battery strings and types of batteries,
maintenance   related   data,   etc.   The   data   can   be
25 obtained   from   existing   or   yet   to   be   implemented
vehicle communication bus structures including the
CAN bus, J1939, J1850, etc. Other types of data
includes bar code information, dealer information,
codes   such   as   warranty   codes,   count   information

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related to how many times or when a particular
battery tester was used, information relating to
promotions or sales, etc. Additionally, data can be a
compilation of data collected over a period of time,
5   either raw data or data which has been analyzed or
otherwise used by the battery tester.

        Figure 3 is a simplified block diagram 70
showing steps associated with the receiving of data
by electronic battery tester 10 over communication
10   link 22. The procedure starts at 72 and at block 74
the formatted data is received from bus 22. This
formatted data is of a similar format to that
discussed in connection with Figure 2 and contains
information along with the address of the electronic
15   battery tester 10. The formatted data is extracted
and retrieved at step 76 and some type of action is
performed at step 78. The particular type of action
can be any type of action including actions in which
the retrieved data is acted upon as a function of the
20   retrieved data, stored in memory 18 for future use,
immediately displayed or otherwise utilized by
battery tester 10, etc.

        Communication link 22 is any type of
physical or non-physical communication link, or a
25   combination. Examples include electrical wiring,
infrared, Radio Frequency (RF), etc. The data carried
on communication link 22 can be unidirectional or bi-
directional and can be in accordance with any
communication protocol. The data carried on

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communication link can be in an encrypted format in
accordance with any encryption technique. In various
aspects, the address of battery tester 10 can be a
shared address, a locally unique address or a
5   globally unique address.

       One example protocol for data on link 22 is
the TCP/IP protocol. In such an embodiment, the
address of battery tester 10 can be an IP (Internet
Protocol) address. For example, RFC791 promulgated by
10   the Internet Engineering Taskforce in September 1981
defines such an address. In one specific example, the
address consists of at least four groups of data,
each group comprises at least 8 bits.

       Data can be sent in response to an event at
15   battery tester 10, at particular times, or in
response to polling from remote location 24. If a
two-way communication link 22 is used, data and/or
programming instructions in tester 10 can be updated
as desired and tester 10 can be controlled from a
20   remote location.

       Remote location 24 can collect data from
one or more battery testers. The data can be placed
into a database format for subsequent analysis. For
example, statistics of the data can be calculated and
25   used in order to diagnose or research battery
failures, sales trends, usage, or other aspects
related to battery tests, installation, use and
ultimate failure. Additionally, data can be
correlated with vehicles, geographical areas,

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dealers, etc., including how battery testers are
being used.

When retrieving data, various types of
information can be retrieved by electronic battery
5   tester 10. For example, battery test parameters or
test criteria can be automatically updated as can
tables or battery ratings. The battery tester
software can be updated as desired as new releases
become available. Service bulletins related to a
10   particular test, or particular type of battery,
particular vehicle or problem associate with a
battery or battery test can be provided to the
operated or stored in the memory for future use. The
test procedures for unusual cars, or tests which are
15   difficult to perform, can be looked up on a remove
database. An authorization can be received in which
the operator receives an authorization to replace a
battery, for example a battery which is under
warranty. The authorizations can be a function of
20   data contained at a remote location, for example if a
particular location has an unusually high rate of
warranty returns, a request for authorization to
return a battery could be denied, or otherwise
identified for subsequent auditing. The battery
25   tester 10 can also take advantage of increased
computing power which might be available at a remove
location. Data available over the internet can be
retrieved for use during the test. For example,
weather information or statistics can be obtained for

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a particular area such that the battery test is
modified as function of the current or predicted
weather. If a cold period is imminent, for example, a
harsher test can be employed. If a battery is
5 replaced, an inventor list can be updated such that a
inventory is reordered, for example, by sending an e-
mail or other communication to a distributor. If the
battery itself has a unique identification, for
example a serial number, this information can be used
10 to monitor the battery from "cradle to grave". For
example, various tests performed throughout the life
of the battery can be utilized to observe trends in
the battery test. Further, service alerts or other
information can be linked to a battery.

15   Figure 4 is a simplified block diagram 100
showing steps performed in accordance with receiving
data from an electronic battery tester in accordance
with the present invention. The receiving can be, for
example, at a remote manufacturing or management
20 site. At block 102 the procedure starts and control
is passed to block 104 where a data pack is received
from the electronic battery tester over the
communication link. At block 106, the data packet is
parsed into the address which identifies the
25 electronic battery tester and the battery test data
contained within the data packet. At block 108, the
battery test data is stored or otherwise operated
upon.   Various examples of such operations are
discussed above.

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Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1.   An electronic battery tester for testing a
storage battery, comprising:

        test circuitry configured to couple to the
            storage battery and provide a battery
            test output related to a condition of
            the battery;

        a memory configured to store a battery
            tester address of the battery tester;
            and

        communication circuitry configured to
            transmit battery test data formatted
            with the battery tester address on a
            communication link to a remote
            location.

2.   A method for testing a storage battery with
a battery tester, comprising:

        coupling to the storage battery and
            providing a battery test output
            related to a condition of the battery;

        retrieving a battery tester address of the
            battery tester from a memory; and

        transmitting battery test data formatted
            with the battery tester address on a
            communication link to a remote
            location.

3.   The invention of claims 1 or 2 wherein the
communication link comprises a physical connection.

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4.   The invention of claims 1 or 2 wherein the
communication   link   comprises   a   non-physical
connection.

5.   The invention of claims 1 or 2 wherein the
communication link is in accordance with TCP/IP.

6.   The invention of claims 1 or 2 wherein the
address comprises an IP address.

7.   The invention of claim 6 wherein the IP
address comprises four groups of eight bits each.

8.   The invention of claims 1 or 2 wherein the
address comprises a unique address.

9.   The invention of claims 1 or 2 wherein the
communication link is bi-directional.

10.   The invention of claims 1 and 2 wherein
coupling to the battery is through a Kelvin
connection.

11.   The invention of claims 1 or 2 wherein the
battery test is related to a dynamic parameter of the
battery.

12.   The invention of claims 1 or 2 including
receiving a user input.

13.   The invention of claim 12 wherein the
battery test data includes data received through the
user input.

14.   The invention of claim 13 wherein the user
input comprises a battery rating.

15.   The invention of claim 13 wherein the user
input comprises a battery type.

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16.   The invention of claims 1 or 2 including
displaying an output related to the condition of the
battery.

17.   The invention of claims 1 or 2 wherein the
battery test data includes the output related to the
condition of the battery.

18.   The invention of claims 1 or 2 wherein the
battery test data includes data used to determine the
condition of the battery.

19.   The invention of claims 1 or 2 wherein the
battery test data includes data received from a bar
code.

20.   The invention of claims 1 or 2 wherein the
battery test data includes data which identifies a
dealer.

21.   The invention of claims 1 or 2 wherein the
battery test data includes a warranty code.

22.   The invention of claims 1 or 2 wherein the
battery test data includes count information.

23.   The invention of claims 1 or 2 wherein the
battery test data includes information related to a
promotion.

24.   The invention of claims 1 or 2 wherein the
battery test data includes a compilation of data.

25.   The invention of claims 1 or 2 wherein the
battery test data is encrypted.

26.   The invention of claims 1 or 2 wherein the
battery test data is transmitted on the communication
link at predetermined times.

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27.   The invention of claims 1 or 2 wherein the battery test data is transmitted on the communication link in response to polling.

28.   The invention of claims 1 or 2 wherein the battery test data includes a vehicle identification number (VIN).

29.   The invention of claims 1 or 2 wherein the battery test data includes data retrieved from a data bus of a vehicle.

30.   The invention of claims 1 or 2 wherein the battery tester retrieves test parameter updates.

31.   The invention of claims 1 or 2 wherein the battery tester receives software updates.

32.   The invention of claims 1 or 2 wherein the battery tester receives service bulletins.

33.   The invention of claims 1 or 2 wherein the battery tester receives test procedures.

34.   The invention of claims 1 or 2 wherein the battery tester receives battery replacement authorization.

35.   The invention of claims 1 or 2 wherein the battery tester receives weather related information.
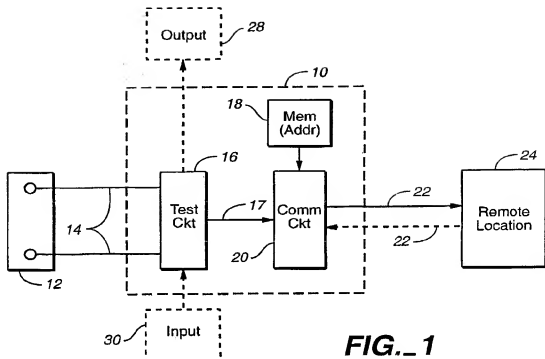
36.   The invention of claims 1 or 2 wherein the battery tester receives information related to the specific battery under test.

37.   A method for receiving battery test data from an electronic battery tester configured to test a storage battery, comprising:

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receiving   a   data   packet   over   a
      communication link;
parsing the data packet into an address
      which   identifies   the   electronic
      battery tester and into battery test
      data   provided   by   the   electronic
      battery tester; and
storing the battery test data.
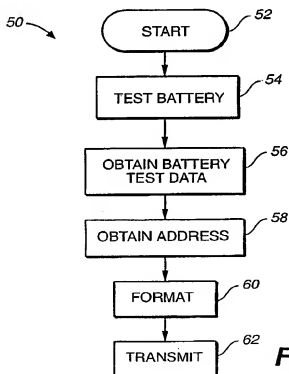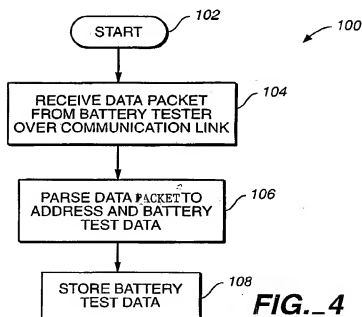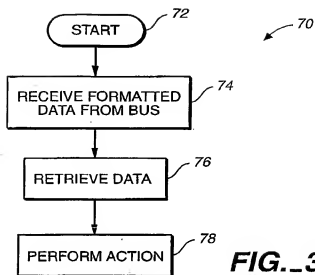
FIG._1

FIG._2

START _72_

_70_

RECEIVE FORMATTED
DATA FROM BUS _74_

RETRIEVE DATA _76_

PERFORM ACTION _78_

FIG._3

START _102_

_100_

RECEIVE DATA PACKET
FROM BATTERY TESTER
OVER COMMUNICATION LINK _104_

PARSE DATA PACKET TO
ADDRESS AND BATTERY
TEST DATA _106_

STORE BATTERY
TEST DATA _108_

FIG._4

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   G01R31/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	WO 00 67359 A (MIDTRONICS INC) 9 November 2000 (2000-11-09) page 1, line 3 - line 6 page 8, line 7 - line 34 page 10, line 8 - line 22 page 23, line 14 -page 24; claims 1,4,7,9,13,18; figure 1 --- -/--	1-37

[X] Further documents are listed in the continuation of box C.	[X] Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 July 2003	24/07/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Binger, B

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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